§25.531 Hull and main float takeoff condition.

For the wing and its attachment to the hull or main float—

(a) The aerodynamic wing lift is assumed to be zero; and

(b) A downward inertia load, corresponding to a load factor computed from the following formula, must be applied:

$$n = \frac{C_{TO} V_{S1}{}^2}{\left(\tan^{\frac{2}{3}} \beta\right) W^{\frac{1}{3}}}$$

where—

n=inertia load factor;

C_{TO}=empirical seaplane operations factor equal to 0.004;

V_{S1}=seaplane stalling speed (knots) at the design takeoff weight with the flaps extended in the appropriate takeoff position;

β=angle of dead rise at the main step (degrees); and

W=design water takeoff weight in pounds.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–23, 35 FR 5673, Apr. 8, 1970]

§25.533 Hull and main float bottom pressures.

(a) *General.* The hull and main float structure, including frames and bulkheads, stringers, and bottom plating, must be designed under this section.

(b) *Local pressures.* For the design of the bottom plating and stringers and their attachments to the supporting structure, the following pressure distributions must be applied:

(1) For an unflared bottom, the pressure at the chine is 0.75 times the pressure at the keel, and the pressures between the keel and chine vary linearly, in accordance with figure 3 of appendix B. The pressure at the keel (psi) is computed as follows:

$$P_k = C_2 \times \frac{K_2 V_{S1}{}^2}{\tan \beta_k}$$

where—

P_k=pressure (p.s.i.) at the keel;

C_2=0.00213;

K_2=hull station weighing factor, in accordance with figure 2 of appendix B;

V_{S1}=seaplane stalling speed (Knots) at the design water takeoff weight with flaps extended in the appropriate takeoff position; and

βK=angle of dead rise at keel, in accordance with figure 1 of appendix B.

(2) For a flared bottom, the pressure at the beginning of the flare is the same as that for an unflared bottom, and the pressure between the chine and the beginning of the flare varies linearly, in accordance with figure 3 of appendix B. The pressure distribution is the same as that prescribed in paragraph (b)(1) of this section for an unflared bottom except that the pressure at the chine is computed as follows:

$$P_{ch} = C_3 \times \frac{K_2 V_{S1}{}^2}{\tan \beta}$$

where—

P_{ch}=pressure (p.s.i.) at the chine;

C_3=0.0016;

K_2=hull station weighing factor, in accordance with figure 2 of appendix B;

V_{S1}=seaplane stalling speed at the design water takeoff weight with flaps extended in the appropriate takeoff position; and

β=angle of dead rise at appropriate station.

The area over which these pressures are applied must simulate pressures occurring during high localized impacts on the hull or float, but need not extend over an area that would induce critical stresses in the frames or in the overall structure.

(c) *Distributed pressures.* For the design of the frames, keel, and chine structure, the following pressure distributions apply:

(1) Symmetrical pressures are computed as follows:

$$P = C_4 \times \frac{K_2\ V_{S0}{}^2}{\tan\ \beta}$$

where—

P=pressure (p.s.i.);

C_4=0.078 C_1 (with C_1 computed under §25.527);

K_2=hull station weighing factor, determined in accordance with figure 2 of appendix B;

V_{S0}=seaplane stalling speed (Knots) with landing flaps extended in the appropriate position and with no slipstream effect; and

V_{S0}=seaplane stalling speed with landing flaps extended in the appropriate position and with no slipstream effect; and

β=angle of dead rise at appropriate station.

(2) The unsymmetrical pressure distribution consists of the pressures prescribed in paragraph (c)(1) of this section on one side of the hull or main float centerline and one-half of that pressure on the other side of the hull or main float centerline, in accordance with figure 3 of appendix B.

These pressures are uniform and must be applied simultaneously over the entire hull or main float bottom. The loads obtained must be carried into the sidewall structure of the hull proper, but need not be transmitted in a fore and aft direction as shear and bending loads.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–23, 35 FR 5673, Apr. 8, 1970]

§ 25.535 Auxiliary float loads.

(a) *General*. Auxiliary floats and their attachments and supporting structures must be designed for the conditions prescribed in this section. In the cases specified in paragraphs (b) through (e) of this section, the prescribed water loads may be distributed over the float bottom to avoid excessive local loads, using bottom pressures not less than those prescribed in paragraph (g) of this section.

(b) *Step loading*. The resultant water load must be applied in the plane of symmetry of the float at a point three-fourths of the distance from the bow to the step and must be perpendicular to the keel. The resultant limit load is computed as follows, except that the value of L need not exceed three times the weight of the displaced water when the float is completely submerged:

$$L = \frac{C_5 V_{S_0}^2 W^{\frac{2}{3}}}{\tan^{\frac{2}{3}} \beta_s \left(1 + r_y{}^2\right)^{\frac{2}{3}}}$$

where—

L=limit load (lbs.);
C_5=0.0053;
V_{S0}=seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect;
W=seaplane design landing weight in pounds;
β_S=angle of dead rise at a station ¾ of the distance from the bow to the step, but need not be less than 15 degrees; and
r_y=ratio of the lateral distance between the center of gravity and the plane of symmetry of the float to the radius of gyration in roll.

(c) *Bow loading*. The resultant limit load must be applied in the plane of symmetry of the float at a point one-fourth of the distance from the bow to the step and must be perpendicular to the tangent to the keel line at that point. The magnitude of the resultant load is that specified in paragraph (b) of this section.

(d) *Unsymmetrical step loading*. The resultant water load consists of a component equal to 0.75 times the load specified in paragraph (a) of this section and a side component equal to 3.25 tan β times the load specified in paragraph (b) of this section. The side load must be applied perpendicularly to the plane of symmetry of the float at a point midway between the keel and the chine.

(e) *Unsymmetrical bow loading*. The resultant water load consists of a component equal to 0.75 times the load specified in paragraph (b) of this section and a side component equal to 0.25 tan β times the load specified in paragraph (c) of this section. The side load must be applied perpendicularly to the plane of symmetry at a point midway between the keel and the chine.

(f) *Immersed float condition*. The resultant load must be applied at the centroid of the cross section of the float at a point one-third of the distance from the bow to the step. The limit load components are as follows:

$$\text{vertical} = {}_{\rho g}V$$

$$\text{aft} = C_x \frac{\rho}{2} V^{\frac{2}{3}} \left(KV_{S_0}\right)^2$$

$$\text{side} = C_y \frac{\rho}{2} V^{\frac{2}{3}} \left(KV_{S_0}\right)^2$$

where—

ρ=mass density of water (slugs/ft.²);
V=volume of float (ft.²);
C_x=coefficient of drag force, equal to 0.133;
C_y=coefficient of side force, equal to 0.106;
K=0.8, except that lower values may be used if it is shown that the floats are incapable of submerging at a speed of 0.8 V_{S0} in normal operations;
V_{S0}=seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect; and